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10/822,691	04/13/2004	Takashi Noguchi	OKI 419	5003

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EXAMINER

NGUYEN, JOSEPH H

ART UNIT PAPER NUMBER

2815

DATE MAILED: 05/24/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

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## Office Action Summary

Application No.

10/822,691

Applicant(s)

NOGUCHI, TAKASHI

Examiner

Joseph Nguyen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 14 April 2005.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-32 is/are pending in the application.
- 4a) Of the above claim(s) 21-32 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 13 April 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                        | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)               | Paper No(s)/Mail Date. _____  |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>4/13/04</u> .   | 6) <input type="checkbox"/> Other: _____                                    |

## DETAILED ACTION

### *Election/Restrictions*

Applicant's election without traverse of claims 1-20 in the reply filed on 04/14/2005 is acknowledged.

### *Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-5, 8, 14, 17 and 20 are rejected under 35 U.S.C. 102(e) as being anticipated by Carden et al. (US 6,552,266).

Regarding claim 1, Carden et al. discloses on figure 2A a heat radiation structure of a semiconductor device, comprising: a substrate 52 (col.3, lines 18-19) having, on a surface thereof, a first area on which the semiconductor device 42 (col. 3, lines 15-16) is mounted, and a second area which surrounds the first area; and the semiconductor device having a first surface and a second surface opposite to the first surface, and formed with a plurality of terminals 44 (figure 1, col. 3, lines 16-17) provided on

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the first surface, wherein the semiconductor device is mounted on the substrate in such a manner that the first surface is opposite to the surface of the substrate, and wherein a first heat radiating film 30 (figure 1, col. 3, lines 25-26) is formed on the second area of the substrate, and a second heat radiating film 20 (col. 3, lines 25-26) is formed on the second surface of the semiconductor device with being spaced away from the first heat radiating film.

Carden et al. teaches in col. 3, lines 25-26 elements 20 and 30 are made of copper. Honda (US 2002/0063331 A1 provided herein as evidence only) teaches in para [0034], lines 15-17 copper comprises the heat radiation property. Therefore, elements 20 and 30 of Carden et al. function as "heat radiating films". Further element 44 is connector (i.e. bumping), electrically connected to the substrate. As such, it functions as "terminal".

Regarding claim 2, Carden et al. discloses on figure 2A a heat radiation structure of a semiconductor device, comprising: a substrate 52 with the semiconductor device 42 mounted on the surface thereof; and the semiconductor device, which includes a first surface, a second surface opposite to the first surface and a plurality of side surfaces provided between the first surface and the second surface and which is formed with a plurality of terminals 44 (figure 1) on the first surface, wherein the semiconductor device is mounted on the substrate in such a manner that the first surface is opposite to the surface of the substrate, and wherein a heat radiating film 30 (figure 1) is formed on the surface of the substrate so as to cover the second surface of the semiconductor device and expose the side surfaces of the semiconductor device.

Note that the side surfaces of the semiconductor device 42 are exposed in the opening 37 (col. 3, line 9).

Regarding claim 3, Carden et al. discloses on figure 2A the substrate 52 is provided with external electrodes 54 (col. 3, lines 20-21) connected to an external board 80 (col. 4, lines 2-3).

Regarding claim 4, Carden et al. discloses on figure 2A the substrate 52 is provided with external electrodes 54 connected to an external board 80, and the semiconductor device 42 is mounted on the substrate in plural form (i.e. a plurality of bumps 44 connecting the semiconductor device 42 to the substrate 52).

Regarding claim 5, Carden et al. discloses on figure 2A the substrate 52 includes external electrodes 54 connected to an external board 80, and the external electrodes 54 are formed on the back of the substrate 52.

Regarding claim 8, Carden et al. discloses on figure 2A the surfaces of the first and second heat radiating films 32, 20 are exposed.

Regarding claim 14, Carden et al. discloses the first and second heat radiating films respectively comprise a common material (col. 3, lines 25-26).

Regarding claim 17, Carden et al. discloses a thermal emission film having thermal radiation is used for the first and second heat radiating films 20, 30 (col. 3, lines 25-26).

Regarding claim 20, Carden et al. discloses on figure 2A a heat radiation structure of a semiconductor device, comprising: a substrate 52 with the semiconductor device 42 mounted on the surface thereof; and the semiconductor device having a first

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surface and a second surface opposite to the first surface, and formed with a plurality of terminals 44 provided on the first surface, wherein the semiconductor device is mounted on the substrate in such a manner that the first surface is opposite to the surface of the substrate, and wherein a thermal emission film 20 having thermal radiation is formed on the surface of the substrate so as to cover the second surface of the semiconductor device.

Claims 1, 2, 6, 9 and 20 are rejected under 35 U.S.C. 102(b) as being anticipated by Mertol (US 5,866,943).

Regarding claim 1, Mertol discloses on figure 3 a heat radiation structure of a semiconductor device, comprising: a substrate 22 (col.8, line 11) having, on a surface thereof, a first area on which the semiconductor device 10 (col. 7, lines 33-34) is mounted, and a second area which surrounds the first area; and the semiconductor device having a first surface and a second surface opposite to the first surface, and formed with a plurality of terminals 13 (col. 7, lines 40-41) provided on the first surface, wherein the semiconductor device is mounted on the substrate in such a manner that the first surface is opposite to the surface of the substrate, and wherein a first heat radiating film 24 (col. 8, lines 48-50) is formed on the second area of the substrate, and a second heat radiating film 26 (col. 9, lines 44-45) is formed on the second surface of the semiconductor device with being spaced away from the first heat radiating film.

Mertol teaches in col. 8, lines 48-50 and col. 9, lines 44-45 elements 24 and 26 are made of aluminum. Honda (US 2002/0063331 A1 provided herein as evidence only)

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teaches in para [0034], lines 15-17 aluminum comprises the heat radiation property.

Therefore, elements 24 and 26 of Mertol function as "heat radiating films".

Regarding claim 2, Mertol discloses on figure 3 a heat radiation structure of a semiconductor device, comprising: a substrate 22 with the semiconductor device 10 mounted on the surface thereof; and the semiconductor device, which includes a first surface, a second surface opposite to the first surface and a plurality of side surfaces provided between the first surface and the second surface and which is formed with a plurality of terminals 13 on the first surface, wherein the semiconductor device is mounted on the substrate in such a manner that the first surface is opposite to the surface of the substrate, and wherein a heat radiating film 24 is formed on the surface of the substrate so as to cover the second surface of the semiconductor device and expose the side surfaces of the semiconductor device.

Regarding claim 6, Mertol discloses on figure 3 wirings 32 are formed on the surface of the substrate 22, and the terminals 13 of the semiconductor device 10 and the wirings of the substrate are electrically connected to one another. Element 32 is bonding pad (col. 8, lines 39-42), which electrically connects the trace conductor 30. Therefore, element 32 functions as wiring.

Regarding claim 9, Mertol discloses on figure 3 wirings 32 are formed on the surface of the substrate 22, and the first heat radiating film 24 is formed so as to cover the wirings 32.

Regarding claim 20, Mertol discloses on figure 3 a heat radiation structure of a semiconductor device, comprising: a substrate 22 with the semiconductor device 10

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mounted on the surface thereof; and the semiconductor device having a first surface and a second surface opposite to the first surface, and formed with a plurality of terminals 13 provided on the first surface, wherein the semiconductor device is mounted on the substrate in such a manner that the first surface is opposite to the surface of the substrate, and wherein a thermal emission film 26 having thermal radiation is formed on the surface of the substrate so as to cover the second surface of the semiconductor device.

Claims 1, 7, 10 and 15 are rejected under 35 U.S.C. 102(b) as being anticipated by Okubora (US 6,504,096 B2).

Regarding claim 1, Okubora discloses on figure 1 a heat radiation structure of a semiconductor device, comprising: a substrate 2 (col.7 lines 2-4) having, on a surface thereof, a first area on which the semiconductor device 10 (col. 7, line 59) is mounted, and a second area which surrounds the first area; and the semiconductor device having a first surface and a second surface opposite to the first surface, and formed with a plurality of terminals 8 (col. 8, line 28) provided on the first surface, wherein the semiconductor device is mounted on the substrate in such a manner that the first surface is opposite to the surface of the substrate, and wherein a first heat radiating film 20 is formed on the second area of the substrate, and a second heat radiating film 16 is formed on the second surface of the semiconductor device with being spaced away from the first heat radiating film.



Okubora teaches in col. 9, lines 4-5 elements 16 and 20 are made of metal. Honda (US 2002/0063331 A1 provided herein as evidence only) teaches in para [0034], lines 15-17 a metal comprises the heat radiation property. Therefore, elements 16 and 20 of Okubora function as "heat radiating films".

Regarding claim 7, Okubora discloses on figure 1 the semiconductor device includes a semiconductor element 10 formed with an electronic circuit and a resin layer 18 (col. 9, line 22) formed on the semiconductor element 10 (formed on the side surface of element 10), and the terminals 8 formed on the resin layer 18 (formed on the side surface of element 18).

Regarding claim 10, Okubora discloses on figure 8 openings (holes between element 20) are defined in the first heat radiating film 20, and parts of the surface of the substrate 2 re exposed through the openings.

Regarding claim 15, Okubora teaches in col.9, lines 4-5 the first heating film 20 is solder paste typically made of Au-Sn or Sn-Pb (col. 9, lines 48-49), which is different material from that of the second heat radiating film 16, made of copper, aluminum, and a glass ceramic (col. 7, lines 60-65). Different material has different thermal expansion coefficient. Therefore, the first heat radiating film and the second heat radiating film are different in thermal expansion coefficient.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Carden et al., and further in view of Chu et al. (US 5,168,348).

Regarding claim 11, Carden et al. discloses on figure 2A substantially all the structure set forth in the claimed invention except openings defined in the second heat radiating film and parts of the second surface of the semiconductor device exposed through the openings. However, Chu et al. discloses figure 3 openings (holes between elements 114) defined in the second heat radiating film 114 (col. 5, lines 8-11) and parts of the second surface of the semiconductor device 102 (col. 4, line 64) exposed through the openings. In view of such teaching, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Carden et al. by having openings defined in the second heat radiating film and parts of the second surface of the semiconductor device exposed through the openings for the purpose of enhancing convective cooling performance on the semiconductor device (col. 3, lines 28-30, Chu et al.).

Regarding claim 12, Chu et al. discloses on figure 3 a seal 112 (col. 5, line 5) is applied onto the second surface of the semiconductor device 102, openings are defined in the second heat radiating film 114, and openings are provided such that the seal is exposed. Note that the term "seal" is merely a label. Element 112 constitutes a similar structure as the claimed seal and therefore can function as a seal.

Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Carden et al.

Regarding claim 13, Carden et al. discloses on figure 2A substantially all the structure set forth in the claimed invention except the thickness of each of the first and second heat radiating films being from 30  $\mu\text{m}$  to 200  $\mu\text{m}$ . However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Carden et al. by having the thickness of each of the first and second heat radiating films being from 30  $\mu\text{m}$  to 200  $\mu\text{m}$ , since it has been held that where the general conditions of a claim are disclosed in the prior art discovering the optimum or working ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

Claims 16, 18 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Carden et al., and further in view of Aoki et al. (US 2003/0037866 A1).

Regarding claim 16, Carden et al. discloses on figure 2A substantially all the structure set forth in the claimed invention except a film having an insulating property used for the first and second heat radiating film. Note that Carden et al. teaches in col. 3, lines 15-26 the first and second heat radiating films 30 and 20 are made of copper. Aoki et al teaches in para [0021], lines 1-6 copper or silica alumina ceramic can be alternatively used for the heat radiating films. Silica alumina ceramic has an insulating property. In view of such teaching, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Carden et al. by having a film

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having an insulating property used for the first and second heat radiating film since they are recognized in the art as equivalents.

Regarding claim 18, Aoki et al. teaches in para [0021], lines 1-6 the material for the first and second heat radiating is ceramic.

Regarding claim 19, Aoki et al. teaches in para [0021], lines 1-6 the material for the first and second heat radiating is silica alumina ceramic.


### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Joseph Nguyen whose telephone number is (571) 272-1734. The examiner can normally be reached on Monday-Friday, 7:30 am- 4:30 pm. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (571) 272-1664. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306 for regular communications.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

JN  
May 18, 2005

  
**TOM THOMAS**  
**SUPERVISORY PATENT EXAMINER**